

one million dozens and that, directly or indirectly, it gives employment to no less than 25,000 persons in London alone.

In his historical sketch of the evolution of artificial mineral waters as we know them to-day, the author shows that progress has been made along two main lines. The existence of these popular beverages undoubtedly had its origin in the desire of the earlier physicians to prepare by artificial means saline solutions which should have the same therapeutic and curative effects as the waters obtained from well-known natural springs such as those of Epsom, Seidlitz or Bath. This necessarily involved some knowledge of the chemical nature of their constituents, and it was not, therefore, until Boyle had given birth to analytical chemistry, and Bergman had brought his genius and industry to bear upon the chemical examination of the waters from many of the mineral springs, that such imitation became possible. At the same time, much speculation was being indulged in as to the exact nature of that wonderful "principle" which gave to many of the natural waters their sparkling character and piquant flavour; and the numerous researches which were being made in this direction culminated in the great discovery by Black of the chemical identity and true nature of carbonic acid gas. Along both these lines the author traces the gradual development of the mineral water industry, showing in true perspective and with due attention to their relative importance the various discoveries or steps by which its present position has been reached. In this connection, we think that the author has attached rather too much importance to Brownrigg's share in the discovery of the true nature of carbonic acid gas, and has perhaps given too little prominence to the masterly researches and brilliant deductions of Black. In the main, however, the chapters dealing with the work of the earlier discoverers are accurately and clearly written, and the book should certainly be read by all who are desirous of acquiring an intelligent knowledge of the beginnings and development of this now important industry.

There are, unfortunately, a few blemishes which ought scarcely to have escaped the author's notice. Thus we are told on p. 3 that the latter half of the eighteenth century witnessed the birth of chemistry, while on p. 13 that honour is assigned to the seventeenth. Whether we are to consider the former, the latter, or, indeed, either of these statements correct will naturally depend upon the precise meaning we are to give to the word "birth," but we presume that the author had in his mind the eighteenth century, which witnessed the labours of Black, Cavendish, Priestley, Scheele and Lavoisier, to mention only some of the giants who laid the foundation on which the wonderful superstructure of modern chemistry has been reared.

The statement on p. 34 that "it is possible to-day to obtain by mechanical and other means water of as great chemical and bacterial purity as any natural water from the deep springs" presumably refers to filtration, but is not by any means clear. On p. 67 we are told that Macquer purified carbonic acid by passing it through a vessel "containing lime and water," but are not told how much of the gas passed through. In connection with

the use of sodium bicarbonate for the preparation of carbonic acid gas, the author makes, on p. 120, the truly astonishing statement that precautions have to be taken to prevent any ammonia present as an impurity from passing over with the gas into the gas holders. We should have thought, as a matter of fact, that the presence of the acid used for its decomposition would have constituted a sufficient "precaution." In one or two places, the language is a little involved, and there are several misprints and slips, such as Becheri for Becher on p. 42, Thiloria for Thilorier on p. 60, and *unabsorbed* would have been better than *unattached* on p. 120. The chapter on the syphon and its development is well written, and like the rest of the book is clearly illustrated by means of well-executed drawings. The author states in his prefatory remarks that he does not intend this to be a manufacturer's handbook, and that therefore he has given no formulæ for the preparation of the various waters. For the same reason, presumably, the description of manufacturing processes and machinery is contained within the limits necessary to render the book acceptable to the general reader. It contains a good index and a well-compiled bibliographical table, and we can, in conclusion, heartily commend it "to all whom it may concern." We cannot, however, help feeling that the author would have done well to have given his book a more independent character by dwelling with rather less emphasis on the excellence of the plant and manufactured products of a particular firm. A. C. C.

DEVELOPMENT OF THE HUMAN EMBRYO

Human Embryology and Morphology. By Dr. A. Keith. Pp. viii+324. (London: Edward Arnold, 1902.) Price 12s. 6d. net.

DR. KEITH is an accomplished anatomist, and in this morphological study of the development of the human embryo he has given us a valuable account, the result of wide and exact personal observation, of all the later phases of organogeny.

The descriptions of the changes that occur during the formation of the face and neck, the alimentary tract, the central nervous system, the heart and blood-vessels, the history of the development of the skeleton and musculature of the head and trunk, are evidently the work of one who is thoroughly familiar with the anatomy, not merely of the human subject, but of the apes and other mammals as well; and in what we may term the "anatomical embryology" here set before us there is much which will be of permanent scientific worth, apart from what is of practical importance for the ordinary surgeon.

From the other aspects, however, we regret that this treatise is less satisfactory. The earnest student who expects to find here a critical exposition of the thorny problems of modern embryology, or even a sufficiently accurate statement of the facts, will be sadly disappointed.

The account of the formation of the germinal layers and of the early changes in the mammalian blastocyst is not only inadequate, it is erroneous; we are told, for instance (p. 89), that "in lower vertebrates the mesoblast is entirely produced from the hypoblast," and (p. 243)

that it is "highly probable that the *cœlom* was originally a series of segmental diverticula derived from inflections of the hypoblast," while no attempt at all is made to discuss the difficult question of the significance of germinal layers. The chapter on the placenta might perhaps have passed muster ten or fifteen years ago.

The epiblastic origin of the pronephric duct is treated as an established fact, and the vertebrate kidney tubule compared to the nephridium of the annelids.

The writer appears to have quite misunderstood the results of recent work on the segmentation of the vertebrate head. On p. 221, for example, it is said that the motor nerve of the fourth cranial segment, comparable, therefore, to the nerves which supply the muscles of the eyeball, is the seventh, and the chorda tympani its sensory root; while the last-mentioned is spoken of here, and in the diagram on p. 35, as pre-spiracular in position, a statement which, however true it may be for some reptiles, is certainly at variance with Broman's careful account of its development in the human embryo.

Again, it would be gathered from the wording on p. 238 that the interventricular septum in Sauropsida is homologous with the similar structure in the mammals; and in chapter xiv. the author has been completely led away by a very dubious theory, to say the least, of the origin of the rods and cones of the retina.

Minor inaccuracies are the ascription of only one dentition to the marsupials (p. 67), the omission of any reference to the possible paired origin of the pineal eye, or to the paraphysis, the derivation of the Eustachian valve from the right valvula venosa alone, and the statement that in fishes the "mesial element" of the diaphragm is alone developed.

Such work as this can hardly be taken as a serious contribution towards the solution of those problems which beset the vertebrate embryologist, and it would have been wiser for Dr. Keith, who appears to intend his book preeminently as a *vade mecum* in the hospital wards, to have resisted the temptation to deal with questions which are beyond the scope and cannot be answered by the methods of mere surgical anatomy. Still, as a practical handbook we hope that this treatise may be a success, especially when, in a future edition, certain orthographical slips—"epiphyseal," "fasiculi," "anastomatic," "systematic" (for "systemic"), "embryoes," "Turicæ" (for "Turcica"), "hypopophysis"—are duly amended.

AN EDUCATIONAL COMPARISON.

The Making of Citizens. A Study of Comparative Education. By R. E. Hughes, M.A., B.Sc. Pp. viii + 405. (London and Newcastle: The Walter Scott Publishing Co., Ltd., 1902.) Price 6s.

THE educationist anxious to keep pace with all that has been written on the very wide subject with which he is concerned has had an almost impossible task during recent years. The annual reports of the Commissioner of Education, Washington, are so bulky—the last, that for 1899-1900, runs to 2348 pages—and the special reports of our own Board of Education are

published so frequently, that one is tempted to give up in despair the effort to master their contents. In addition to these official publications there are the books written by private persons who have studied foreign methods of education on the spot. Mr. Hughes has, in the book before us, endeavoured to meet this difficulty, and to provide students with "a complete and accurate account of the present position of education in the four principal countries of the world," by which he means England, France, Germany and the United States of America. In the compilation of the volume, free use has been made of the official reports mentioned, and numerous quotations from many writers show that the author has a good knowledge of recent educational literature.

The plan of the book is very simple. After some preliminary pages, separate chapters are devoted to the primary school systems of each of the countries under comparison; after this a general view of the working of primary schools is followed by an account of higher elementary schools. The secondary schools of the four countries are allotted a chapter each, and the book is completed by a *résumé* of the provisions made for the education of girls and for the training of defective children.

With the wealth of material he had from which to select, it was not to be expected that Mr. Hughes would please everybody; naturally the same subjects do not appear of equal importance to all authorities. For instance, in our opinion too little attention is paid to the question of the science teaching in the schools described. The prominence given both in England and America to the need for rational methods in the teaching of science, and to the desirability of the inclusion of some instruction in the methods of science in schools of every grade, is scarcely mentioned by Mr. Hughes. We are told that the science side and master of the best English secondary schools are only tolerated (p. 307), and that chemistry is the favourite and first science taken up (p. 320), though it does not seem to be mentioned that this preference for chemistry as the initial science study is less marked year by year. It is pointed out that the German teacher relies upon the lecture rather than upon the laboratory method (p. 253), that the heuristic method is becoming the accepted way of teaching science in American high schools, and that in them it is usual to begin with the study of physics (p. 280); but these odd paragraphs exhaust all that is said on this important subject.

In view of the influence which science has exerted upon manufacture, commerce and thought generally, a careful comparison of the place which science teaching takes in schools of every grade in the four countries concerned would have been most valuable. The book is intended, however, for the ordinary person with a general interest in education, and this may explain why Mr. Hughes has given more prominence to administrative matters than to questions of curriculum. It only remains to be said that the author's personal acquaintance with English education and his wide experience of schools have enabled him to bring together in convenient compass very much of interest and importance about American, French and German systems of education.